
Chapter 1

Introduction

This report documents King County's review of its combined sewer overflow (CSO) control program conducted in accordance with policies and guidelines in the 1999 Regional Wastewater Services Plan. The first three chapters provide background information on planning and implementation of CSO control. Chapter 4 discusses the results of the program review and describes other factors that influence CSO control planning. Finally, Chapter 5 describes the activities that will follow the review, including implementation of the next CSO control projects.

The remainder of this chapter gives an overview of the purpose of the review and describes the nature and locations of CSOs in King County, the reasons for controlling CSOs, and the County's CSO control strategies.

1.1 Why Conduct a Program Review?

In 1993, work began on the Regional Wastewater Services Plan (RWSP), a revision to the 1958 comprehensive sewer plan for the wastewater service area in King County. Adopted in 1999, the plan sets out to integrate long-range planning in all areas of wastewater services and to establish priorities for all wastewater programs. One component of the RWSP is a CSO control plan that describes King County's program and schedule to reduce CSOs. King County implements the CSO control plan through the Wastewater Treatment Division's CSO control program.

The CSO control plan in the RWSP was updated in 2000 and submitted to the Washington State Department of Ecology (Ecology) in conjunction with renewal of the NPDES permit for the West Point Treatment Plant. No changes to the CSO control plan were recommended under the 2000 plan update, mainly because the permit renewal application was due only 6 months after adoption of the RWSP.

In adopting policies for the RWSP, the King County Council recognized that much can change in 5 years. Science and technology are continually evolving. This new knowledge, as well as changes in conditions and costs, must be considered in planning for CSO control. To this end, RWSP policy requires that the benefits of completion of the CSO program be reviewed before finalizing commitments under the NPDES permit. This CSO program review has been completed for Council consideration and input. Findings will be incorporated into the CSO plan update that will be submitted to Ecology in 2008 as part of the next NPDES renewal.¹

¹ NPDES (National Pollutant Discharge Elimination System) permits are defined later in this chapter. These permits are usually renewed every 5 years. The CSO plan update that was expected to be due in 2005 will now be submitted in 2008 because of a delay in Ecology's NPDES permit renewal schedule.

1.2 What Are CSOs?

CSOs are untreated wastewater and stormwater that discharge directly from CSO outfall pipes into marine waters, lakes, and rivers during heavy rainstorms when sewers are full.

There are two types of sewer systems in the King County wastewater service area: separated and combined (Figure 1-1). In separated systems, sanitary sewers carry untreated wastewater to a treatment plant and storm sewers carry stormwater from rooftops, driveways, sidewalks, streets, and other impervious surfaces to the nearest water body. Separated systems are now considered standard engineering practice, but this was not always the case. A hundred years ago, the common practice was to provide a single sewer pipe to carry both wastewater and stormwater. Until the early 1940s, nearly all sewers constructed in Seattle were combined sewers; separated sewers have been standard practice since about 1950. The City of Seattle is the only local wastewater agency served by King County that has a combined sewer system.

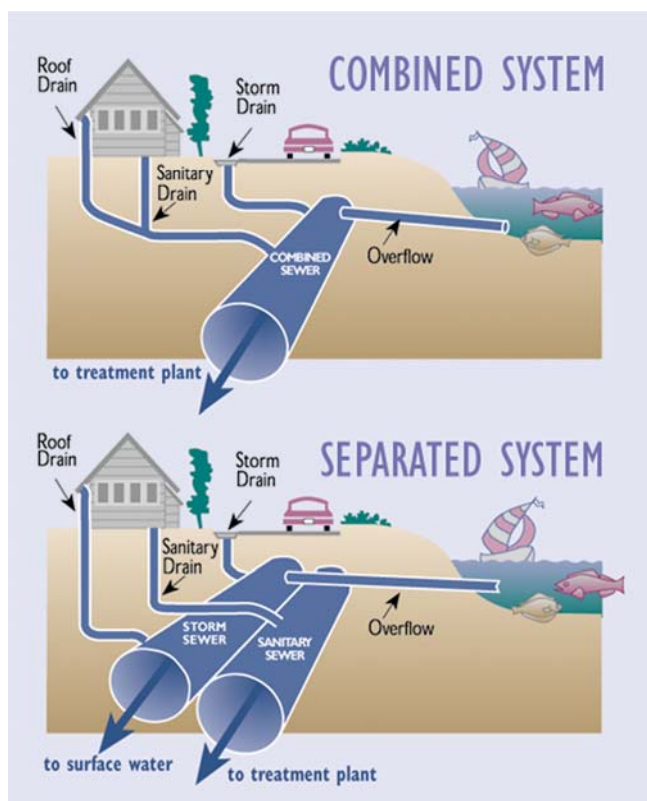


Figure 1-1. Combined and Separated Wastewater Conveyance Systems

In combined systems, wastewater and stormwater are carried through the same pipes. Wastewater flows in combined sewers are fairly constant, but stormwater flows fluctuate greatly depending on the amount of rainfall, its intensity, and the ability of the soil to absorb the rainfall. During large storms, the sewers may collect more stormwater than the pipes and treatment plants can handle. CSO outfalls act as relief points to protect treatment plants from huge influxes of water that could compromise treatment processes and also to prevent wastewater from backing up into streets and basements.

1.3 What Is King County's Role in Wastewater Management?

In 1958, the Municipality of Metropolitan Seattle (Metro) was formed to clean up the waters of Lake Washington and the Seattle waterfront. At the time, most wastewater in King County was transported from homes and businesses by sewers that discharged the untreated wastewater to the nearest water body. In the 1960s, Metro assumed ownership of the City of Seattle's wastewater treatment plants and portions of its sewer system and then built large pipes, called interceptors, to carry regional wastewater from local systems to the treatment plants.

In 1994, King County assumed Metro's responsibilities for regional wastewater management. Today, King County's Wastewater Treatment Division serves 34 cities and districts in and adjacent to King County. The County operates a "wholesale" business, providing wastewater conveyance and treatment services to "retailers" (local agencies), who in turn sell wastewater services to area residents and businesses.

King County's wastewater system is the largest in the Puget Sound region (Figure 1-2). The system includes two large regional treatment plants (the West Point plant in the City of Seattle and the South plant in the City of Renton), one small treatment plant on Vashon Island, one community septic system (Beulah Park and Cove on Vashon Island), four CSO treatment facilities (Alki, Carkeek, Mercer/Elliott West, and Henderson/Norfolk—all in the City of Seattle), over 335 miles of pipes, 19 regulator stations, 42 pump stations, and 38 CSO outfalls. The West Point, South, and Vashon plants provide secondary treatment; the CSO treatment facilities provide CSO treatment (the equivalent to primary treatment).² All seven treatment facilities discharge their treated and disinfected effluent to Puget Sound. Two new treatment plants are currently in design: the Brightwater regional plant, scheduled to start operating in 2010, and a smaller local treatment plant in the City of Carnation, scheduled to start operating in 2007.

The King County wastewater service area is divided into the East and West Sections. Separated wastewater from more than 122,000 acres that lie mostly east and south of Lake Washington is sent to the South Treatment Plant. The area west of Lake Washington sends a mixture of separated wastewater from north of Lake Washington and combined wastewater and stormwater flows from the City of Seattle to the West Point Treatment Plant. Approximately 41,000 acres of the 55,000 acres that comprise Seattle are served by combined or partially separated sewers. Once the new Brightwater plant is online, nearly all flow to West Point will be from the Seattle system.

The City of Seattle owns about 100 and King County owns 38 CSO outfalls (Figure 1-3). The two agencies communicate frequently and participate in each other's CSO planning efforts. Both

² In primary treatment, solids are removed from the wastewater, usually by allowing them to settle to the bottom of large tanks. The wastewater is then disinfected, usually with chlorine, and discharged. Secondary treatment includes primary treatment, followed by a biological process to break down organic material, more solids settling, and then disinfection and discharge.

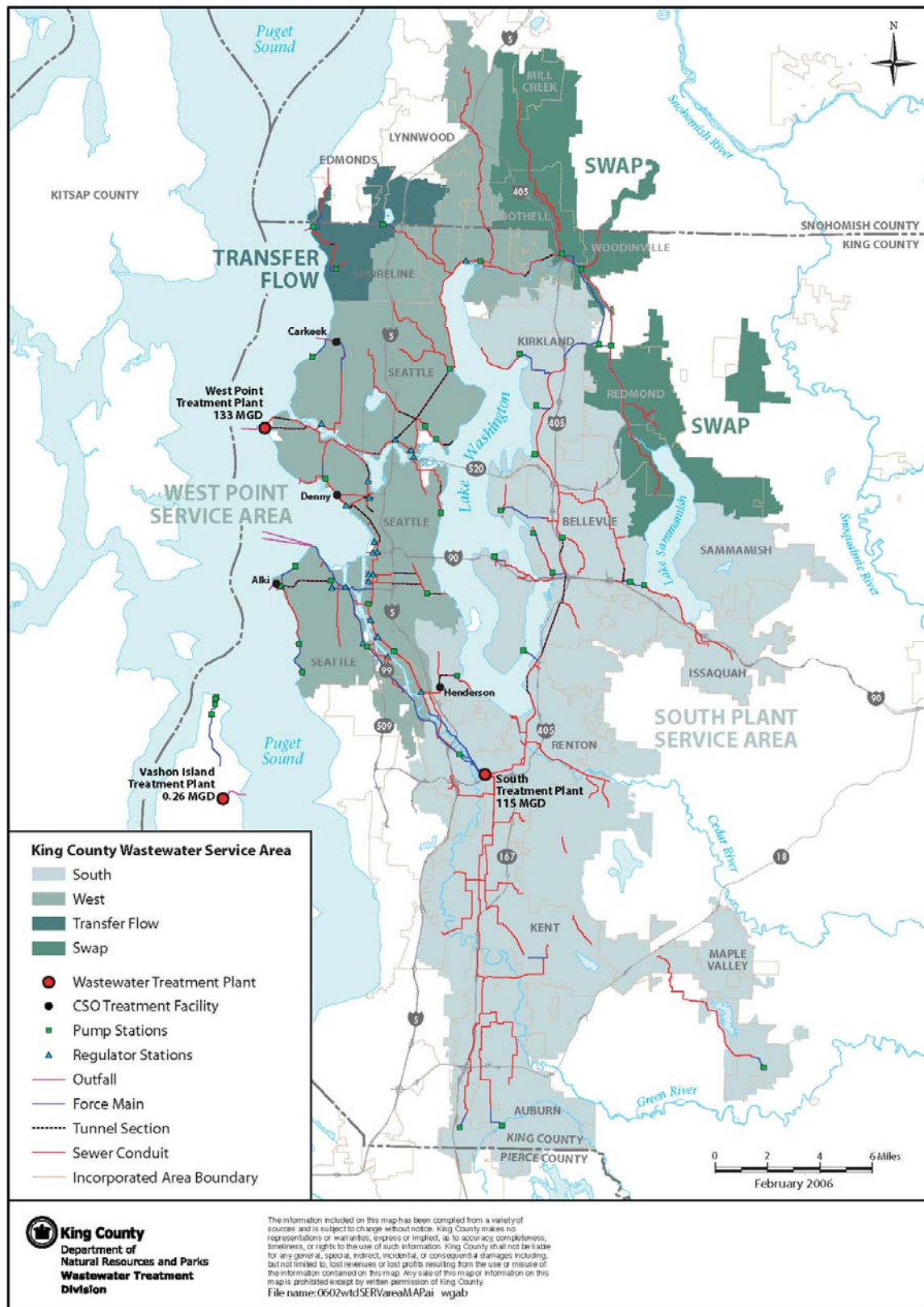


Figure 1-2. King County Wastewater Service Area and System



Figure 1-3. King County and City of Seattle Combined Sewer Overflow Locations

agencies pursue joint CSO control projects if the projects are deemed to be cost-effective for ratepayers or if they minimize disruption to nearby communities.

To prevent duplication and conflicts, the County and City also coordinate their stormwater and wastewater management programs. In areas served by combined sewers, the City manages stormwater before it enters the County sewers; the County manages the stormwater after it enters the County sewers. In areas served by separated sewers, the City manages most of the stormwater.³ County policy prohibits construction of facilities to handle “clean” stormwater from separated sewers managed by the City or other agencies. Stormwater causes extreme variations in wastewater flows, resulting in the need for large facilities and in challenges to the treatment process.

1.4 Why Reduce CSOs?

The mission of King County’s Wastewater Treatment Division (WTD) is to protect public human health and the environment by conveying and treating the region’s wastewater. Human waste has long been recognized as a source of serious health risks, such as infant diarrhea and cholera. Public health and life expectancy can be improved dramatically when wastewater is properly managed. Regional improvements in collecting, conveying, and treating wastewater that were made after the formation of Metro in 1958 continue to be effective despite decades of population growth and development.

Although they are highly diluted, CSOs release potentially harmful bacteria and pollutants, may cause aesthetic degradation, and may reduce sediment quality near the discharge sites. Regulations, agreements, policies, and public perceptions require, either directly or indirectly, the reduction of CSOs to protect water quality, sediment quality, and aquatic species in our water bodies. WTD makes a policy of designing, constructing, operating, and maintaining its facilities to meet or exceed regulatory requirements.

1.4.1 Water Quality Regulations

In 1972, the federal Clean Water Act was adopted. The primary objective of the Clean Water Act (CWA) is to restore and maintain the integrity of the nation’s waters. This objective translates into two national goals: to eliminate the discharge of pollutants into the nation’s waters and to achieve and maintain fishable and swimmable waters. One way that the first goal is being achieved is through the National Pollutant Discharge Elimination System (NPDES) permit program. The second goal is being addressed by developing pollution control programs to meet specific water quality standards for water bodies.

CWA requires all wastewater treatment facilities and industries that discharge effluent into surface waters to have an NPDES permit. NPDES permits are issued by Ecology and set limits on the quality and quantity of effluent discharged from point sources such as treatment plants,

³ The County is responsible for the stormwater that results from County sewer separation projects; it also accepts contaminated stormwater from industries and charges a fee to recover costs.

CSOs, and industrial facilities. King County holds NPDES permits for its West Point, South, and Vashon Treatment Plants. The West Point NPDES permit includes the Alki and Carkeek CSO treatment plants, the CSO outfalls, and the newly constructed Mercer/Elliott West and Henderson/Norfolk CSO storage and treatment facilities.

To evaluate water quality and to set permit limits to protect water quality, Ecology has put into regulation use-based Water Quality Standards (WAC 173-201A)—aimed at keeping waters clean and safe for people, fish, and wildlife. The biological, chemical, and physical criteria used to assess a water body’s health include fecal coliform bacteria, dissolved oxygen, temperature, pH, ammonia, turbidity, and a variety of other chemical compounds. These standards apply to the area in a water body that extends beyond a defined “mixing zone,” where a CSO discharge mixes with the ambient water.

When a water body does not meet these Water Quality Standards, Section 303(d) of the CWA requires that the water body be added to a list of impaired waters called the “303(d) list.” The 303(d) list is published every 4 years. Once listed, the water body must be studied and controls must be put into place that will correct conditions so that it meets standards. Controls often involve dividing the pollutant load into allocations to its sources, such as stormwater runoff and municipal or industrial discharges, that the water body can assimilate and still meet the standards. This process is called a Total Maximum Daily Load (TMDL). Most of the water bodies where King County CSOs occur are on the 303(d) list and will require TMDLs.

Regulations that Affect CSO Control Planning

Clean Water Act (CWA)—Adopted in 1972 to eliminate the discharge of pollutants into the nation’s waters and to achieve and maintain fishable and swimmable waters.

National Pollutant Discharge Elimination System (NPDES)—The Washington State Department of Ecology (Ecology) implements the CWA by issuing NPDES permits to wastewater agencies and industries that discharge effluent (including CSOs) to water bodies.

Water Quality Standards—To implement CWA, Ecology has developed biological, chemical, and physical criteria to assess a water body’s health and to impose NPDES permit limits accordingly.

State CSO Control Regulations—Ecology requires agencies to develop plans for controlling CSOs at the earliest possible date so that an average of one untreated discharge per year occurs at each location.

Wet Weather Water Quality Act of 2000—The U.S. Environmental Protection Agency (EPA) requires agencies to implement Nine Minimum Controls and to develop long-term CSO control plans.

Sediment Quality Standards—Ecology developed chemical criteria to characterize healthy sediment quality and identified a threshold for sediment cleanup. King County has participated in sediment cleanup at some of its CSO locations.

Endangered Species Act (ESA)—Two fish species that use local water bodies where CSOs occur have been listed as threatened under ESA.

1.4.2 CSO Control Regulations

In 1984, Ecology introduced legislation requiring agencies with CSOs to develop plans for “the greatest reasonable reduction [of CSOs] at the earliest possible date.” In January 1987, Ecology published a new regulation (WAC 173-245) that defined the greatest reasonable reduction in CSOs as “control of each CSO such that an average of one untreated discharge may occur per year.” The new regulation also defined standards for treated CSOs.

The U.S. Environmental Protection Agency's (EPA's) 1990 CSO Control Policy was codified as the Wet Weather Water Quality Act of 2000 (H.R. 4577, 33 U.D.C. 1342(q)). This act requires implementation of Nine Minimum Controls for CSOs and the development of long-term CSO control plans. The purpose of the Nine Minimum Controls is to implement early actions that can improve water quality before the more expensive capital projects in the control plan are built. The requirements of this act are incorporated in the NPDES permit for the West Point plant.

1.4.3 Sediment Quality Regulations

Ecology is granted legal authority under WAC 173-204, Sediment Management Standards, to direct the identification, screening, ranking, prioritization, and cleanup of contaminated sediment sites in the state. The standards include the sediment quality standards (SQS), which are chemical-specific criteria that designate what is considered healthy sediment quality, and a threshold called the Cleanup Screening Level (CSL) for sediment cleanup efforts ("remediations"). When these chemical criteria are exceeded, toxicity testing may be used to verify the adverse impact. Once a site is ranked and placed on the contaminated sites list, it may then be considered for cleanup. WAC 173-204 provides for the voluntary cleanup of contaminated sediments with oversight and guidance by Ecology. Alternatively, Ecology or EPA may initiate enforcement actions (including cost recovery) under the Washington Model Toxics Control Act (MTCA) or the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund.

1.4.4 Endangered Species Act

In 1999, chinook salmon and bull trout were listed as threatened species under the Endangered Species Act (ESA).⁴ In 2000, NOAA Fisheries adopted a draft protective rule under section 4(d) of ESA prohibiting the "take" of the listed species.^{5,6} Following the adoption of the rule, King County began a review of its activities to determine how WTD should modify its practices, including construction practices and uses of property near water bodies, to stay within the parameters set out in the 4(d) rule.

For treatment plant discharges, NOAA stated in the 4(d) rule that it would work with permitting authorities (Ecology) to ensure that permitted discharges do not violate ESA. NOAA Fisheries, the U.S. Fish and Wildlife Service (USFWS), and EPA have signed a Memorandum of Agreement to work together on integrating the CWA standards and the ESA requirements. Both NOAA Fisheries and USFWS have the opportunity to review NPDES permits.

⁴ In February 2006, killer whales were listed as endangered under the ESA.

⁵ NOAA (National Oceanographic and Atmospheric Administration) Fisheries was formerly known as the National Marine Fisheries Service.

⁶ Take under ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct [ESA §3(19)].

1.4.5 Public Perception and Preferences Regarding CSOs

King County's 1998 *Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay* included valuable input from regional stakeholders. The message heard during this process and during RWSP formation—that water quality is a priority to the citizens of King County, that the County has a mandate to protect and enhance water quality, and that the citizens believe CSOs should be controlled—has been continually reaffirmed through all WTD public involvement activities since the RWSP was adopted. In a recent survey, 75 percent of the respondents said that CSOs should be prevented even if the effort increases sewer rates.

1.4.6 Policy Commitments and Agreements

In adopting the RWSP, King County set policies for completing CSO control by 2030. The CSO control plan in the RWSP identifies 21 projects that, when completed, will bring all County CSOs into compliance with the one-per-year discharge requirement by 2030. The plan conforms to RWSP policies by giving priority to CSO control projects in areas where discharges have the greatest potential to impact human health and/or species listed under ESA. The RWSP policy also recognizes that plans and priorities must adapt to changing conditions.

Other commitments include the commitment to reserve capacity at the West Point plant for CSO control and the agreements made with regional elected officials on how to fund the RWSP, including CSO control.

1.5 What Is King County Doing to Control CSOs?

The County prepares and updates its CSO control plan to reflect the current state of science and regulation and to integrate CSO control with other WTD capital improvement programs. Various strategies to monitor and control CSOs include controlling pollution at its sources, maximizing use of existing system capacity, monitoring and modeling flows in the system, and constructing new CSO control facilities.

To save costs and to provide a high level of treatment, WTD operates its system so that to the extent possible, CSO flows are sent to regional plants for secondary treatment. An automated control system manages flows through the conveyance system so that the maximum amount of flow is contained in pipelines and storage facilities until it can be conveyed to the plant. In some areas of the system where flows cannot be conveyed to the plant, the flows are sent to CSO treatment facilities for CSO treatment prior to discharge. Untreated CSOs are discharged only when flows exceed the capacity of these systems.

Construction of CSO control facilities in the region began in the late 1970s. So far, about \$320 million has been spent to control CSOs and another \$383 million is planned to implement the CSO control projects in the RWSP. Many early projects involved sewer separation, flow diversion, and storage tunnels. Most current and future projects involve construction of

conveyance improvements, storage tanks, and treatment facilities. In 2005, two major facilities were finished. The Mercer/Elliott West system, done in collaboration with the City of Seattle and completed at a cost about \$140 million, includes two improved outfalls, a tunnel that both stores and treats flows, and additional treatment facilities. The Henderson/Norfolk system, completed at a cost of \$77 million, also includes a large storage/treatment tunnel and additional treatment facilities.

Since 1988, when monitoring and measuring of CSO flows began, these control efforts have reduced CSO volumes from an estimated 2.4 billion gallons per year to approximately 900 million gallons per year (Figure 1-4). The County is committed to reducing CSOs even further in the years ahead.

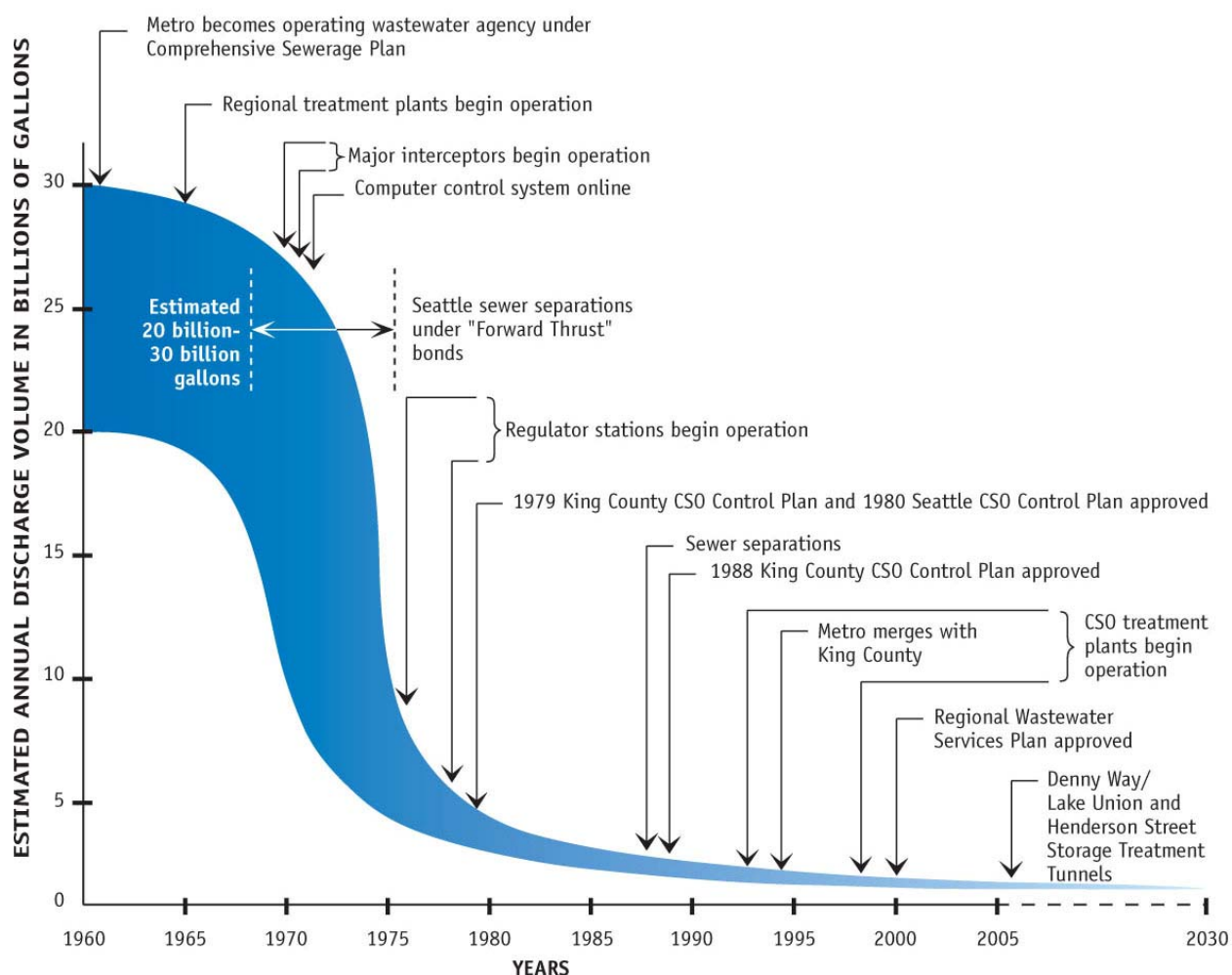


Figure 1-4. Reduction in CSO Volumes Over Time